In the latter case a comparison of the various test prints is simplified by placing them alongside each other on a flat surface of suitable size.

Standard test strips

Standard exposed test strips for monitoring negative development are supplied by Agfa together with a standard strip which has already been developed. It is very important that the expiry date printed on these strips should be observed, as they can only be expected to give satisfactory results up to this date. It is a good plan to keep these strips in a cool place, although this is not absolutely necessary. For monitoring the paper processing results it is possible to make one's own test prints by making a large number of exposures at once from the control negative for the Colormator and using them to test development in the manner described on page 179 (control of colour developer). For evaluating and comparing these strips it is advisable to use a densitometer. Agfa will be glad to supply further particulars of the monitoring procedure using test strips and of their evaluation.

Test prints

Analytical control

In addition to this sensitometric control of the developing results, an analytical control of the processing solutions is also possible. This supplies information on the cause of errors resulting from faulty composition of the processing bath. The instructions for carrying out these chemical analyses can also be supplied by Agfa if required. It should be noted, however, that properly trained staff should be available for analyses of this kind if it is wished to avoid mistakes which could lead to erroneous conclusions and the obvious disadvantages associated with them. In cases of doubt the result of the sensitometric strip should always be taken as a criterion as this represents the actual results obtained in the developed photographic material. It would be exceeding the scope of this book to deal at length with all the details of work with printing machines. All the required information in this respect can be obtained from the instructions for use of the various machines, e.g. for the Colormator N, Colormator U, or Labomator N and Labomator U respectively. The main object of this section was to draw attention to the fundamental conditions involved in producing colour prints with machines of this kind. If the points mentioned are carefully followed this will be of great benefit in obtaining satisfactory results.

I. Practice of Masking

The integral colour mask in Agfacolor CN 17 S negative films eliminates in a very simple way any faults which unmasked films still display. On the other hand, some cases in practical colour photography have shown that it is better to use unmasked material with a separate additional mask. For example, the gradation in integral masks is constant and it is not possible to make it softer or harder, although there are cases where it is desirable to have harder or softer gradation, i.e. to be able to control the effect of mask gradation. In such cases it can be a great advance to use separate masks in conjunction with unmasked negatives. This should be borne in mind in connection with the following remarks.

I. Production of Grey Masks (Silver Masks)

Production of grey masks (silver masks)

a) Grey Masks (Silver Masks) (cf. Section C, page 72 and figure 41)

A colour image of hard gradation always produces more saturated colours than one of soft gradation. One is therefore inclined to neglect the required tonal separation in a print for the sake of this increased colour saturation. By using a monochrome mask, the contrast of a strongly saturated colour print can be lessened without impairing its high colour saturation; in other words, colour prints of normal, satisfactory gradation are obtained which still have high colour saturation. In this connection it should be borne in mind that masks may reduce the exposure latitude of the colour film slightly and that they depend on a good colour balance because any tendency towards a colour cast will naturally be emphasized by a higher degree of colour saturation. If colour filters are used during the production of grey masks, their effect will be limited to brightness changes in the colours without affecting the colour hues. Every colour filter used in producing grey masks increases the density of all colours which are of the same colour as the filter and reduces the density of the relevant complementary colour. Thus, a yellow filter increases the density of all yellow colour hues and lowers that of all blue shades. Neither grey masks nor the use of colour filters in their preparation result in a change of colour hues.

Colour filters

Grey masks, silver masks

The following procedure should be adopted for the production and use of grey masks:

1. The developed Agfacolor negative is printed, emulsion to emulsion, on a panchromatic black and white film (Agfa Isopan sheet film).
2. The exposure is made through Agfacolor printing filter 90 00 00 (yellow) or, preferably, through Agfa Repro Filter 5 (yellow). The mask should receive a generous exposure.
3. The mask is given black and white development in Agfa Atomal for 6—8 minutes or Agfa 14 for 3—4 minutes at 68° F to a gamma of 0.4—0.5. The result is a very flat, dense positive lacking in contrast, the grey mask.
4. The mask is bound up back to back with the Agfacolor negative, or at least with the emulsion side of the mask facing the back of the negative, if the mask has been produced in the same manner. As a first step the two films are joined along one of their longitudinal edges by means of a piece of colourless adhesive tape. After checking the register on the surface of a printing box, the other longitudinal edge is also fastened with adhesive tape. This back-to-back arrangement of the films produces the effect of slight diffusion and suppresses minor differences in register. In the case of original negatives on 35 mm film the mask is prepared on perforated black and white miniature film (Isopan F). Here the perforations facilitate arrangement in register. Any errors in register of the masks cause undesirable relief effects in the print, whereas moderately unsharp masks will yield sharp prints, hence the back-to-back position of mask and colour negative.
5. This combination of colour negative and mask is inserted in the enlarger or printer with the emulsion side of the Agfacolor negative facing the Agfacolor paper and the exposure is then made. The exposure given through the mask is approximately 5—10 times as great as when not using a mask. The print is corrected to give the usual neutral balance by means of printing filters. To all intents the filter combination is unchanged compared with a neutral print made from the same negative without a mask. The required grade of paper will depend on the quality of the colour negative. Normally developed Agfacolor negatives (6—7 minutes) will require Agfacolor Paper Hard whereas for Agfacolor negatives given more contrasty development (longer, 10—12 minutes) Agfacolor Paper Normal will be used. Only in special cases where gradation of the print need not be taken into account can the contrasty Agfacolor negative be used with a mask on Agfacolor Paper Hard to ensure better colour saturation. In each case prints having much more saturated colours than those given by a normal colour negative without a grey mask will be obtained.

Register eyelets

A highly successful aid in ensuring accurate register of grey and coloured masks is the so-called register eyelet supplied by Messrs. Klimsch & Co., Frankfurt-on-Main. In this case the negative or transparency and masking film are punched and then connected with each other by means of the eyelets so that they cannot move in any way. The mask is then exposed, and after development the same register can be obtained in a simple manner by using the eyelets gain.

b) Grey Masks having the same Gradation as the Negatives

Grey masks having the same gradation as the negatives

Agfa Isopan F Film is used for producing grey masks with the same contrasting gradation as the original negative (see figure 42) and is developed in Agfa 71 for 5—6 minutes at 68° F (see formula below). Exposure and use of the mask are as described under Ia. The combination of negative and mask must appear without gradation and contrast in transmitted light, and if this requirement is not met development of the mask was either too long or too short. Prints on Agfacolor Paper Normal or Hard give images lacking gradation and without differences in brightness, but with very luminous, saturated colours.

c) Grey Masks with Excess Gradation

Grey masks with excess gradation

Agfa Isopan F Film is used for the production of grey masks having a harder contrasting gradation than the original colour negative (cf. figure 43) and is developed in Agfa 71 for 10—12 minutes at 68° F (see page 224). The grey mask of excess gradation is made and used in the same manner as the normal grey mask (cf. Section Ia). In the print, however, the very hard positive gradation of the mask exercises a more marked effect than the flat gradation of the colour negative. The result is that a negative appears in the print made on Agfacolor Paper Normal or Hard (the bright colours in the negative turn out dark, the dark colours bright), but the colours remain positive. This excess-gradation mask should only be used for special effects.

Paper prints from transparencies

II. Production of Paper Prints from Agfacolor Reversal Originals (Transparencies) with the Aid of Grey Masks

When producing colour prints from colour transparencies the material chiefly used is Agfacolor Paper CU which is given reversal development, i.e. the reversal print. In special cases, such as when this reversal paper is not available, paper prints of this kind can be produced from colour transparencies by means of an intermediate negative. However, during the two-stage process of copying the transparency on to a colour negative film and making a print from the negative thus obtained, there is an excessive loss of colour saturation due to faulty absorption of the component dyes. For this reason it is highly advisable to use a grey mask in order to increase colour saturation. The procedure adopted for making these grey masks and their use is as follows:

1. A copy is made of the transparency on Isopan FF miniature film through Agfa Printing Filter 99 00 00 (yellow) or Agfa Repro Filter 5 (yellow) with emulsion facing emulsion.
2. The Isopan FF film is developed in Agfa Atomal 6—8 minutes or in Agfa 14 (see formula below) for 5—7 minutes at 68° F. A monochrome negative is obtained, the grey mask.
3. The grey mask is bound up back-to-back in register with the Agfacolor transparency (cf. Ia).
4. The combined Agfacolor transparency and mask is inserted in the enlarger with the emulsion side of the transparency facing the easel of the enlarger and an exposure is made on Agfacolor Negative Film CN 17 with a preliminary filter combination of 000 120 120.
5. The Agfacolor Negative Film CN 17 is developed to a colour negative in accordance with the usual instructions. Development time 8—10 minutes at 68° F.
6. From this Agfacolor negative a print or enlargement is made on Agfacolor Paper Normal or Hard, an image of neutral balance being obtained in the usual manner by means of the printing filters.

Coloured masks

III. Coloured Masks

Apart from improving colour saturation, coloured masks also rectify faulty colour rendering caused by unwanted secondary colour densities of the negative dyes (cf. Section C, figures 40, 44—46). In particular the magenta dye reveals detrimental effects in this respect. Its secondary

colour density in the blue region of the spectrum renders all blue colours too dark, all the yellows too bright, and green hues are often changed in the bluish green direction. The coloured masks automatically formed in CN 17 S eliminate these errors. The rules for general use of integral and separate coloured masks are as follows:

1. The mask (print) should be made from the colour layer whose dye reveals faulty secondary absorptions (e.g. the magenta dye).
2. The mask must be dyed in the colour contained as a "false" colour in the faulty dye (i.e. yellow in the case of the magenta dye).
3. The gradation of the colour mask must be identical with and complementary to that of the secondary colour density to be masked.
4. Since the complementary gradation of the colour mask reduces the gradation of the "true" dye in the layer of the same colour in a multilayer film (e.g. the yellow layer) this loss has to be made good by an additional negative of the colour in question having the same gradation as the mask.

As the main faults in colour rendering are caused by unwanted absorption of the magenta dye in the blue spectral region (yellow secondary colour density) the mask required to remove it must be coloured yellow. Hence, according to 1, a print (mask) of the magenta image in the magenta layer must be made and (2) dyed yellow. Thus the print is made by exposing a green-sensitive material (ortho- or panchromatic) to green light (complementary to magenta). This print is then dyed yellow to give a yellow mask. Compensation for the loss in gradation of the primary yellow (4) caused by subtraction of the (yellow) secondary colour density (in magenta) due to the action of the mask is provided by a negative dyed yellow and having a gradation identical with that of the mask. For this purpose the yellow image in the yellow layer is printed on blue-sensitive material through a blue filter and given monochrome development. The black and white positive obtained in this manner is in turn printed on monochrome material and the resulting negative dyed yellow. This compensating negative must have a gradation equal and complementary to the yellow mask. Yellow mask and compensating negative must be bound up in register together with the original colour negative. The combination of these three films serves as a printing "sandwich" for the final print on paper.

Gradationless yellow corrective

This comparatively cumbersome procedure is simplified in a ingenious way by the production of a "gradationless" yellow corrective combining the yellow mask and yellow compensating negative in one film. The following method is adopted:

1. Production of a print from the Agfacolor negative through a blue filter (Agfa 252 L) on monochrome film (Agfa Process Film C ortho) with emulsion facing emulsion.
2. Development of the print to a monochrome transparency with a gamma = 1.0. Developer Agfa 71 undiluted (see page 224). development time 3—5 minutes or 6—10 minutes in Agfa 71 diluted with 10 parts water at 68° F. Choice of the development time will depend on the required gamma of 1.0.
3. Binding in register of the monochrome blue filter transparency together with the colour negative, emulsion to emulsion (use adhesive tape or register eyelets as described in Section I, page 218).
4. Control of correct blue filter transparency gradation: When the combination of colour negative and monochrome transparency (blue filter transparency) is viewed by transmitted light on a printing box through an Agfa 54 green filter, a step-wedge, if present in the negative, should show a continuous area of uniform density. Furthermore, all the blue colours of the original (yellow colours in the negative) must show a lower density and all the yellow colours of the original (blue colours in the negative) must show a higher density than the area of the step-wedge. If a step-wedge was not incorporated in the colour negative, grey tones of the original contained in the negative should be used as a control. All the grey tones, irrespective of their varying densities in the original, must be of equal density in the film combination. In comparison, blue colours of the original must have a lower density, all yellow colours a higher density. If this condition is not satisfied the blue filter transparency must be exchanged accordingly for another one of different gradation. If the condition is satisfied,
5. the film combination is printed on a monochrome material, preferably the same as that mentioned under section 1 (Agfa Process Film C ortho) through an Agfa 54 green filter. The back of the colour negative should face the emulsion side of the process film.
6. This print is then developed yellow (see page 224) and represents the yellow corrective.

7. Control of gradation and exposure in the corrective: The corrective is satisfactory if the step-wedge area or, in its absence, all the grey tones of the original show an identical yellow density in the corrective. It should be of medium strength. Apart from this, the yellow colours of the original should be clear in the corrective or, at the most, show a very thin yellow veil. On the other hand, all blue colours of the original should have a heavier density than the grey tones. The controls described for the yellow and blue tones of the original should be applied all the more closely if no step-wedge was included in the exposure. It should be noted that the colours mentioned refer to the colours of the original, i.e. they must be complementary in the colour negative concerned. The density of the corrective should be kept as low as possible to avoid any undue increase in the exposure time for the print. If a check of the corrective should make it clear that the three conditions described have not been satisfied the blue filter separation, still combined with the colour negative, must be replaced by one of different gradation. It can easily be seen whether the new blue filter separation should be softer or harder in gradation than the old colour separation from differentiation in the step-wedge or the green and blue colours of the original, according to the preponderance in the step-wedge area by the density of the blue filter transparency or of the colour negative.

8. Combination of the yellow corrective with the Agfacolor negative. The yellow corrective replaces the monochrome blue filter transparency previously combined with the colour negative by means of adhesive tape etc. as described above. The best method of checking accurate register is to use a printing box or something similar with an illuminated surface identical in size with the colour negative. A blue Agfa 252 L filter is placed on this surface, followed by the colour negative emulsion side downwards; the corrective is arranged with its emulsion facing the back of the colour negative and carefully in register with it. Alternatively, the blue filter may be omitted from the illuminated surface and used for checking purposes by holding it in front of the observer's eye.

9. The combination of Agfacolor negative and corrective is then used as a printing "sandwich" to make an enlargement or print on Agfacolor Paper Normal or Hard. The combination is inserted in the enlarger in

the usual manner with the emulsion side of the colour negative facing the printing material. Properly made yellow correctives yield colour prints with more saturated colours, particularly in the yellow and blue tones, and the green tones will show less tendency to reveal a bluish tinge.

Similarly, correctives of different colours may be produced to eliminate other faults in the dye components (cf. section C). Since, however, these faults exercise considerably less effect than the secondary colour density of the magenta dye, they are not specially mentioned here in order to avoid confusion.

Developer formulae for masks

IV. Developer Formulae for Masks

1. Agfa 14 developer for the production of grey masks

Metol	4.5 g
Sodium sulphite anh.	85 g
Sodium carbonate anh.	1 g
Potassium bromide	0.5 g
Water	1000 cc

2. Agfa 71 developer for the production of contrasty grey masks and for monochrome development of the blue filter separation for the yellow corrective

Metol	5 g
Sodium sulphite anh.	40 g
Hydroquinone	6 g
Potassium carbonate	40 g
Potassium bromide	3 g
Water	1000 cc

Monochrome masks and the blue filter colour separation are correctly exposed if they show good detail in the shadows and in the highlights and if an evenly graduated step-wedge included in the colour negative has uniform gradation over its entire length.

3. Yellow Development of the Corrective

Development takes place in the normal colour developer for Agfacolor Negative and Positive Film M in which 2 g of yellow colour coupler* are dissolved per litre.

* Yellow colour coupler is supplied by Agfa Leverkusen.

Processing sequence for yellow development:

Development	6	minutes at 64° F
Wash	5	„
Agfacolor Negative Fixing Bath **	5	„
Wash	5	„
Agfacolor Negative Bleaching Bath	5	„
Wash	5	„
Agfacolor Negative Fixing Bath	5	„
Final wash	5—10	„

** The white light can be switched on after one minute.

The final wash should not be too long as the yellow dye produced during development dissolves slightly during prolonged washing. The strength of the corrective, or its "contrast" or "gradation", can be influenced within certain limits by varying the length of colour development depending on the characteristics of the original subject. A subject with very strong colour requires a "harder" corrective than a subject with less saturated colour, i.e. the corrective should be given longer or shorter development respectively. Very hard correctives produced by extra prolonged development lead to exaggerated improvements in the colours and the prints frequently appear to be of a lower quality than unmasked prints.

Principles governing the use of masks

In the main two principles should govern the use of masks or correctives:

1. The use of masks is only worth while if the additional work involved justifies the costs, i.e. chiefly in cases where a large number of prints are required from the same negative or publicity material of special value or printing blocks are involved.
2. Every masking technique requires special training but in the hands of an experienced and technically skilled photographer it is an excellent means of enhancing the colour effect.

10. Historical Table of Agfacolor Photography

1727	J. H. Schulze	Discovery of the sensitivity to light of silver salts
1826	J. N. Niepce	First known photograph on the basis of light sensitive asphalt
1839	J. L. M. Daguerre	Discovery of photography on the basis of light sensitive silver jodide. Daguerreotype process
1840/41	F. Talbot	Negative-positive process on paper base, Calotype process
1850/51	Le Gray/Archer	Collodion emulsions on glass plates
1855	J. C. Maxwell	Additive process of colour photography
1862	Ducos du Hauron	Subtractive process of colour photography
1871	J. Maddox	Gelatine emulsions, dry plates
1873	H. W. Vogel	Optical sensitisation
1887	H. Goodwin	Film base
1908	Lumière	First plates for colour photography (additive) (screen plates, Autochrome screen plates)
1909	R. Fischer	Colour development
1916	Agfa	Agfacolor screen plate (additive)
1932	Agfa	Agfacolor lenticular (additive)
1935	Kodak	Kodachrome reversal colour film (colour development, subtractive, colour couplers in colour developer)
1936	Agfa	Agfacolor "new" reversal colour film (colour development, subtractive, non-diffusing colour couplers in the film)
1940	Agfa	First cinema film based on Agfacolor negative-positive process (subtractive)
1942	Agfa	Publication of first colour prints on paper by the Agfacolor negative-positive process
1949	Agfa	Agfacolor negative film and paper released for general use. Agfacolor Negative Films CNT and CNK — 14° DIN/20 ASA, Agfacolor Paper Normal CN 111
1951	Agfa	Agfacolor Paper Hard (CH 111)
1952	Agfa	Agfacolor Reversal Film for daylight (CUT) and for artificial light (CUK) — 15° DIN/25 ASA
1956	Agfa	Agfacolor Negative Film CN 17 (universal film) — 17° DIN/40 ASA
1957	Agfa	Agfacolor Reversal Film CT 18 — 18° DIN/50 ASA Agfacolor Reversal Film CK — 17° DIN/40 ASA

1958	Agfa	Agfacolor negative-positive process released for user processing Agfacolor Negative Film CN 14 — 14° DIN/20 ASA. Agfacolor Reversal Cine Film CT — 13° DIN/16 ASA. Direct prints from reversal originals on Agfacolor Reversal Paper: CT print
1960	Agfa	Greatly improved colour rendering for Agfacolor paper, Colour Developer Pa I/60 with non-irritant effect
1961	Agfa	Processing sequence K for Agfacolor paper
1963	Agfa	Agfacolor Paper MCN 111: Paper with much higher sensitivity suitable for printing from masked and unmasked negatives
1963	Agfa	Agfacolor Positive Film M: Increased speed (like MCN 111 paper). For masked and unmasked negatives.
1963	Agfa	Agfacolor Negative Film CN 17 M: Colour negative film with a double mask supplied in Rapid type cassettes specially for the USA (replaced in 1966 by Agfacolor Negative Film CN 17 Special)
1966	Agfa	Agfacolor Negative CN 17 Special: Colour Negative Film (17° DIN/40 ASA) with a double mask supplied as roll and miniature film and in Rapid type cassettes
1966	Agfa	Agfacolor Reversal Cine Film CK 17: A high-speed fine-grain Super 8 cine film for artificial light, can be exposed in daylight with a conversion filter
1966	Agfa	Agfacolor process at 25° C (77° F) for processing paper, takes only 17½ min. Shortest wet processing time in the world for paper rolls

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